

REMARKS

Claims 1-36, all the claims pending in the application, stand rejected on prior art grounds.

Claims 1, 10, and 24-28 have been amended herein. Moreover, no new matter is presented.

Applicants respectfully traverse these rejections based on the following discussion.

I. The Claim Rejections

Claims 1-36 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mirkin et al. (U.S. Patent Publication No. 2002/0063212), hereinafter referred to as "Mirkin", in view of Haubold et al. (U.S. Patent Publication No. 2003/0032192), hereinafter referred to as "Haubold", and further in view of Cubicciotti (U.S. Patent Publication No. 2002/0034757).

Mirkin teaches a lithographic method referred to as "dip pen" nanolithography (DPN). DPN utilizes a scanning probe microscope (SPM) tip (e.g., an atomic force microscope (AFM) tip) as a "pen," a solid-state substrate (e.g., gold) as "paper," and molecules with a chemical affinity for the solid-state substrate as "ink." Capillary transport of molecules from the SPM tip to the solid substrate is used in DPN to directly write patterns consisting of a relatively small collection of molecules in submicrometer dimensions, making DPN useful in the fabrication of a variety of microscale and nanoscale devices. The invention also provides substrates patterned by DPN, including submicrometer combinatorial arrays, and kits, devices and software for performing DPN. The invention further provides a method of performing AFM imaging in air. The method comprises coating an AFM tip with a hydrophobic compound, the hydrophobic compound being selected so that AFM imaging performed using the coated AFM tip is improved compared to AFM imaging performed using an uncoated AFM tip. Finally, the invention provides AFM tips coated with the hydrophobic compounds.

Haubold teaches methods for the preparation of inorganic nanoparticles capable of fluorescence, wherein the nanoparticles consist of a host material that comprises at least one dopant. The synthesis of the invention in organic solvents allows gaining a considerably higher yield compared to the prior art synthesis in water. All kinds of objects can advantageously be marked and reliably authenticated by using an automated method on the basis of a characteristic emission. Further, the size distribution of the prepared nanoparticles is narrower which renders a subsequent size-selected separation process superfluous.

Cubicciotti teaches single-molecule selection methods for identifying target-binding molecules from diverse sequence and shape libraries. Complexes and imprints of selected target-binding molecules are also provided. The subject selection methods are used to identify oligonucleotide and nonnucleotide molecules with desirable properties for use in pharmaceuticals, drug discovery, drug delivery, diagnostics, medical devices, cosmetics, agriculture, environmental remediation, smart materials, packaging, microelectronics and nanofabrication. Single oligonucleotide molecules with desirable binding properties are selected from diverse sequence libraries and identified by amplification and sequencing. Alternatively, selected oligonucleotide molecules are identified by sequencing without amplification. Nonnucleotide molecules with desirable properties are identified by single-molecule selection from libraries of conjugated molecules or nucleotide-encoded nonnucleotide molecules. Alternatively, target-specific nonnucleotide molecules are prepared by imprinting selected oligonucleotide molecules into nonnucleotide molecular media. Complexes and imprints of molecules identified by single-molecule selection are shown to have broad utility as drugs, prodrugs, drug delivery systems, willfully reversible cosmetics, diagnostic reagents, sensors, transducers, actuators, adhesives, adherents and novel multimolecular devices.

As amended independent claims 1, 10, and 24-28 contain features, which are patentably distinguishable from the prior art references of record. Specifically, claim 1 recites, "A scanning probe microscope tip coated with a layer of chemically-synthesized nanoparticles stuck to said tip." Similarly, claim 24 recites, in part, "...depositing nanoparticles over said tip, wherein said nanoparticles are stuck to said tip..." Likewise, claims 10 and 25-28 recite, in part, "...wherein said step of dipping causes said nanoparticles to stick to said scanning probe microscope tip..." These features are simply not taught or suggested in the prior art references of record, specifically Mirkin, Haubold, and Cubicciotti. Furthermore, the claimed invention would not have been obvious to a person having ordinary skill in the art. Moreover, the proposed combination of Mirkin, Haubold, and Cubicciotti asserted in the Office Action, even if legally combinable, would still fail to teach all of the novel elements of the claimed invention.

While the claimed invention and the inventions of Mirkin and Cubicciotti all relate to applying secondary materials to scanning probe tips. There are several patentably distinct elements which the claimed invention contains, which the prior art simply does not teach. For example, the claimed invention differs from the prior art in its intended application, the method of coating, and the materials used to coat the SPM tips. The coating materials and methods in the claimed invention are optimized for achieving the narrowly defined task of imaging physical properties with high spatial resolution; something which could not be achieved by the prior art inventions in any of their embodiments. In fact, there are several ways in which the tips of the claimed invention differ from the prior art tips, and these differences impart unique advantages for the claimed invention's intended application.

The invention of Haubold et al. relates to a method of synthesizing nanocrystals. Many such methods exist (see e.g. C. B. Murray, D. J. Norris, M. G. Bawendi, J. Am. Chem. Soc. 115,

8706 (1993), L. Brus in "Materials Chemistry: An Energy Discipline," G. A. Ozin ed., p. 335 (ACS Sympos. Ser. No. 245 1995)). As clearly noted, the Applicants do not claim the nanocrystals themselves; rather the claimed invention relates to a novel application of nanocrystals. That is, applying nanoparticles to the end of an AFM tip. In fact, the claimed invention provides a methodology of applying nanoparticles to the end of an AFM tip in a carefully controlled manner, which does not constitute an "obvious" application of Haubold. Furthermore, the magnetic nanocrystals used in the preferred embodiment of the claimed invention cannot be synthesized by the technique of Haubold.

Intended use:

The claimed invention provides a means of imaging novel physical modalities (magnetic field, electronic structure, optical properties) with high resolution. Such an application is neither taught nor implied by Mirkin, Haubold, or Cubicciotti. Neither could the cited prior art inventions achieve this goal in any of the described embodiments.

The molecules that coat the tips of Mirkin are specifically designed to come off the tip and transfer to the substrate so as to impart useful properties to the substrate. In contrast, the claimed invention is specifically designed to keep the nanoparticles rigidly affixed to the tip, with the aim of imparting new properties to the tip; specifically the ability to image physical properties with high resolution.

The invention of Cubicciotti provides a means of identifying and isolating individual molecules by means of their interactions with compounds attached to an SPM tip. The invention of Cubicciotti relies on short-range chemical interactions between the coating on the tip and the test molecules. In contrast, the claimed invention provides primarily a means of physical

characterization of surfaces, as described in the preferred embodiments.

Coating Procedure:

The coating procedure of the claimed invention provides an unequalled degree of control over the position and number of nanocrystals attached to the tip, allowing the claimed invention to form tips with the geometries specified in dependent claims 7, 8, and 9. This degree of control is neither taught nor implied by the other inventions. Moreover, the claimed techniques of depositing nanocrystals from a monolayer floating on a liquid subphase (Claim 11), or from a monolayer on an elastomer (Claim 12) guarantee deposition of only a single monolayer of nanocrystals over a well-defined region of the tip. When the nanocrystals are deposited from a bulk solution via adsorption or drying, as suggested by Mirkin and Cubicciotti, they form a disordered aggregate which renders the tip useless for high-resolution imaging. This is not a problem for Mirkin because he deposits molecules rather than nanocrystals, and the molecules are small enough that they do not appreciably affect the geometry of the tip. Cubicciotti is not concerned with high resolution imaging, so his tips do not need carefully controlled geometry. A high level of control over the distribution of nanocrystals on the tip is key to achieving a high spatial resolution.

Materials:

Mirkin coats an SPM tip with a solution of functional molecules, where these molecules have a property, which is desired to be imparted to a surface. When the tip approaches a substrate, these molecules are transferred from the tip to the substrate. In contrast, the claimed invention coats an SPM tip with a thin layer of nanocrystals, where these nanocrystals have a

physical property, which is desired to be imparted to the SPM tip. In fact, the claimed invention is restricted to materials that stick irreversibly to the tip, while the invention of Mirkin et al. is restricted to materials that do not stick to the tip. In view of the strong shear forces that are exerted on an SPM tip under typical operating conditions; the development of strategies for rigidly affixing nanocrystals to the tip is a technical challenge to which the Applicants have found a non-obvious solution.

The properties of the materials mentioned in Mirkin are quite different from the properties of nanocrystals; specifically nanocrystals may have finely tuned magnetic, electronic, and optical properties. These physical properties allow the claimed invention's SPM tips to image novel physical modalities, something which the tips of Mirkin cannot do.

Extensive research and development went into imparting the the desired geometry and physical properties of the claimed invention's tips; properties not found in the tips of Mirkin or Cubicciotti. Moreover, the simple drying procedure provided by Haubold would not achieve the desired results if applied to coating SPM tips.

Insofar as references may be combined to teach a particular invention, and the proposed combination of Mirkin, Haubold, and Cubicciotti in various combinations with one another, case law establishes that, before any prior-art references may be validly combined for use in a prior-art 35 U.S.C. § 103(a) rejection, the individual references themselves or corresponding prior art must suggest that they be combined.

For example, in In re Sernaker, 217 U.S.P.Q. 1, 6 (C.A.F.C. 1983), the court stated:

"[P]rior art references in combination do not make an invention obvious unless something in the prior art references would suggest the advantage to be derived from combining their teachings."

Furthermore, the court in Uniroyal, Inc. v. Rudkin-Wiley Corp., 5 U.S.P.Q.2d 1434 (C.A.F.C.

1988), stated, "[w]here prior-art references require selective combination by the court to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gleaned from the invention itself. . . . Something in the prior art must suggest the desirability and thus the obviousness of making the combination."

In the present application, the reason given to support the proposed combination is improper, and is not sufficient to selectively and gratuitously substitute parts of one reference for a part of another reference in order to try to meet, but failing nonetheless, the Applicant's novel claimed invention. Furthermore, the claimed invention, as amended, meets the above-cited tests for obviousness by including embodiments such as having the nanoparticles stick to the microscope tip. As such, all of the claims of this application are, therefore, clearly in condition for allowance, and it is respectfully requested that the Examiner pass these claims to allowance and issue.

As declared by the Federal Circuit:

In proceedings before the U.S. Patent and Trademark Office, the Examiner bears the burden of establishing a prima facie case of obviousness based upon the prior art. The Examiner can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references. In re Fritch, 23 U.S.P.Q.2d 1780, 1783 (Fed. Cir. 1992) citing In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

Here, the Examiner has not met the burden of establishing a prima facie case of obviousness. It is clear that, not only does Mirkin fail to disclose all of the elements of the claims of the claimed invention, particularly, a scanning probe microscope tip coated with a layer of chemically-synthesized nanoparticles stuck to the tip, as discussed above, but also, if combined with Haubold and Cubicciotti, fails to disclose these elements as well. The unique

elements of the claimed invention are clearly an advance over the prior art.

The Federal Circuit also went on to state:

The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. . . . Here the Examiner relied upon hindsight to arrive at the determination of obviousness. It is impermissible to use the claimed invention as an instruction manual or "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This court has previously stated that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. Fritch at 1784-85, citing In re Gordon, 221 U.S.P.Q. 1125, 1127 (Fed. Cir. 1984).

Here, there is no suggestion that Mirkin alone or in combination with Haubold and/or Cubicciotti, teaches a structure and method containing all of the limitations of the claimed invention. Consequently, there is absent the "suggestion" or "objective teaching" that would have to be made before there could be established the legally requisite "prima facie case of obviousness."

Additionally, clearly the invention is part of a crowded art field. As such, given the crowdedness of the art, the novel aspects of the invention should be regarded as a significant step forward in the constant development of this technical art field.

In view of the foregoing, the Applicants respectfully submit that the collective cited prior art do not teach or suggest the features defined by amended independent claims 1, 10, and 24-28 and as such, claims 1, 10, and 24-28 are patentable over Mirkin alone or in combination with Haubold and/or Cubicciotti. Further, dependent claims 2-9, 11-23, and 29-36 are similarly patentable over Mirkin alone or in combination with either Haubold or Cubicciotti, not only by virtue of their dependency from patentable independent claims, respectively, but also by virtue of the additional features of the invention they define. Thus, the Applicants respectfully request that

these rejections be reconsidered and withdrawn.

Moreover, the Applicants note that all claims are properly supported in the specification and accompanying drawings, and no new matter is being added. In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejections.

II. Formal Matters and Conclusion

In view of the foregoing, the Applicants submit that claims 1-36, all the claims presently pending in the application, are patentably distinct from the prior art of record and are in condition for allowance. Furthermore, no new matter is presented. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 50-0510.

Respectfully submitted,

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